My interest in becoming an excellent researcher started when I was exposed in my final year of undergraduate school to the work of well-known research scientists in the domain of nonlinear dynamic systems and structures. What was fascinating to me was the intensity of their analytical framework and computation that made me interested to learn how to take an idea from its inception, to frame the problem statement and understand the underlying mathematical architecture to make the scientific case for the study. Based on the frameworks from the paper, I was inspired to begin my project on the dynamic systems of structures. Fortunately, I was able to contact the original researchers when I needed some clarification on how they formulated their analytical framework, explained where I was stuck and was able to get help with deducing some of their advanced mathematical foundations that enabled me to move forward. Working and collaborating with this team which included the original researchers, my research professor, and scholar and myself; we were able to unpack the process by which they traveled from the conception of the idea, the design of the system to generation of the mathematical frameworks to their analytical findings, simulation, and numerical analysis. It was a joy to use their work as a model to understand how this kind of research was done. This is what sparked my interest in research and propelled me to volunteer my time as a student researcher with my professor. With this project as the basis, we investigated the coupled nonlinear behavior of a beam structure with a moving mass under different conditions introducing kinematic nonlinearities into the system, thereby developing a comprehensive coupled analytical nonlinear geometric model. By applying Hamilton's principle, and other analytical frameworks we derived a coupled mathematical formulation of the desired system, capturing the nonlinear behavior. This led us to observe the complex nonlinear dynamic behavior by inferring resonance phenomena from the data generated from the simulation of the system, deducing traveling waves characteristics from data visualization and understanding the influence of different boundary conditions on the dynamic response of the system by experimenting with different time and space data at the endpoints of the system. This provided us with valuable insights into the dynamic behavior of such systems and their potential applications in engineering design and small-scale electronic devices. This resulted in the publication of a paper that I authored with my professor and scholar titled “Coupled non-linear behavior of beam with a moving mass”. Although this was a research project related to my field of mechanical engineering at the time, it illustrates my abilities as a researcher using simulation data analysis and developing algorithm to build the simulator to utilize the data generated from the simulation to validate analytical frameworks of the system. The intensive research experience coupled with comprehensive data analysis and visualization permeated an interest in me to pursue a graduate program in mechanical engineering with data science: I did this because I saw the opportunity to take relevant courses and pursue projects in data science along with engineering that would inform me about the world of data analytics and engineering to make decisions and inferences with artificial intelligence and machine learning models and applications. During my graduate program, I learned about the value of using AI to develop applications that helped to realize the depth of the domain that I was eager to learn more about. This gave me the pathway to delve into specialized domains of machine learning which included computer vision, natural language processing, deep learning, and system design with parallel computing. As part of the courses, I did literature and research studies that

helped me to understand the conceptual framework of the researchers in these domains. I also gained valuable research experience working on course research projects in various domains among which some of them are aspect-based sentiment analysis with transformer and BERT models, visual dynamics and physical reasoning by representation learning, deep reinforcement learning for developing trading algorithm, deep learning and self-attention on images to infer lane detection and ML informed analysis on material science. One of the notable research projects was conducting study on a research article based on Aspect-Based Sentiment Analysis (ABSA) using Supervised Contrastive Pre-Training Learning (SCAPT) with transformer encoder and BERT to build a language model implicit sentiment classifier. It was first done by pre-training the data with SCAPT and used transformer encoder and BERT fine-tuning thereby having two models and then compared the accuracy between standalone models of transformer encoder and BERT models without SCAPT over the two models with SCAPT pre-training and fine-tuning respectively. We experimented with the model on a new dataset achieving an average of 86% accuracy on both models over other cases which substantiated their results to more general dataset. I was also part of a computer vision course research project where we conducted a literature study and analyzed the researchers results on a lane detection model by learning from key-point features developed from each associated lane image with ResNet model having self-attention layer and encoder-decoder model. We built an algorithm by applying another model ResNeXt replacing their ResNet model as the backbone architecture to achieve an average F1 score of 94%. Another project that helped me to understand concepts at system level was when we built an application with parallel computing techniques to enhance the performance of a stereoscopic depth perception algorithm with primary use case for precise depth perception in autonomous vehicles and augmented reality systems to name a few. Here we delved into the realm of GPU utilization, employing CUDA and numba libraries and addressed memory allocation challenges. The goal was to develop an algorithm capable of determining stereoscopic depth perception with a massive number of pixel calculations, specifically 3 billion pixels and we utilized global memory, a 2D grid, and 32 threads per block framework. The implementation of parallel computing techniques yielded remarkable results, enhancing the computation time by 147x compared to the sequential algorithm due to the effective distribution of computational tasks across multiple processors. Furthermore, higher accuracy of approximately 85% in determining stereoscopic depth perception validated the effectiveness of the parallel computing approach. This project helped me to grasp complex computational problems and devise innovative solutions using cutting-edge parallel computing techniques with GPU utilization, memory management, algorithm optimization and high-performance computing. In addition to my research experience, I also had the opportunity working as a data scientist at a startup organization and as a machine learning intern in another organization. In these roles, I gained experience working on real-world AI and ML problems, such as developing features to improve the accuracy of search and recommendation algorithm and building ML applications for language inference, entity detection, knowledge graph, language translation, information extraction, document classification and summarization. My application reflects a commitment to engage in research using critical thinking, problem solving and collaborative work – pursuing independent and team projects which contributed to the whole. The two years of pursuing a master's degree in

engineering and data science led me to increase my understanding of and fueled my interest in AI and ML. This program afforded me the chance to work in so many interesting ways with my colleagues across disciplines, along with the opportunity to work with well- established professors in computer science via courses and research projects. Besides academic and research experience, working as a student assistant on campus enabled me to meet students from other disciplines, understand and learn the latest development in AI/ML and experience the richness of campus life. It strengthened my leadership and communication skills and gave me the opportunity to show my initiative, take responsibility and share my talents in organizing events and support various diverse communities across campus. On that note, I am currently a part of an organization that fosters international students, diversity and inclusive communities and am working with their database administration and data engineering team. Reflected in my application, statement and resume is my interest in asking questions, persisting and being willing to engage in a variety of creative methods that enable me to utilize technology to address important real-world problems. I have been fascinated by AI, ML, and data since I was an undergraduate student, and I am excited about the potential of these technologies to revolutionize many aspects of our lives and to be part of it.